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REMARKS

Pending Claims

Claims 11-12, 14-17, 19-22 and 24-30 are pending in this application. Claims

11, 16, 21, 24 and 27 have been amended. No new matter has been added.

Claim Rejections under 35 U.S.C. §103

Claims 11-12, 14-17, 19-22 and 24-30 are rejected under 35 U.S.C. §103(a) as

being unpatentable over Milligan et al., U.S. Patent No. 5,210,866 and further in view

of Bachmat et al., U.S. Patent No. 6,237,063.

Applicants have amended each independent claim to clarify that which they

regard as the invention. In particular, it is set forth in each of the amended claims that

said host computer issues a swap request to said storage system and said storage system

issues a device busy request to said host computer when said storage system receives an

access request to said first logical volume or said second logical volume from said host

computer upon processing said swap request for said first logical volume and said

second logical volume.

For example, in claim 11 Applicants have amended the claim to further recite

that said host computer issues a swap request to said storage system, said swap request

exchanging positional information of the first logical volume with that of the second

logical volume, so that data of said first logical volume is interchanged with data of said

second logical volume and said controller accesses said second physical storage area

when said controller receives an access request to said first logical volume from said

host computer, and said storage system issues a device busy request to said host

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computer when said storage system receives an access request to said first logical

volume or said second logical volume from said host computer upon processing said

swap request for said first logical volume and said second logical volume. Likewise,

independent claims 16, 21, 24 and 27 have each been amended for consistency to set

forth similar recitations as found in claim 11.

According to claim 11, the computer system comprises a host computer and a

storage system which stores data to be accessed by the host computer, wherein the

storage system includes a first physical storage area in one or more disks in the storage

system and a controller for accessing the one or more disks. The first physical storage

area corresponds to a first logical volume accessed by the host computer. Further, the

host computer stores data in the first physical storage area and a backup copy of the data

is stored to a tape at a certain point in time. After the certain point in time and upon

occurrence of a failure in a sequence of processing executed by the host computer, the

host computer selects an unused second logical volume in the storage system, where the

second logical volume corresponds to a second physical storage area, reads the backup

copy from the tape and writes the backup copy of the data to the second logical volume.

The controller then accesses the second physical storage area when the controller

receives an access request to the first logical volume from the host computer when the

host computer issues a swap request to said storage system, said swap request

exchanging positional information of the first logical volume with that of the second

logical volume, so that data of said first logical volume is interchanged with data of said

second logical volume and said controller accesses said second physical storage area.

And, then said storage system sets a value of a device busy request of said positional

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information of each of said first logical volume and said second logical volume to

indicate busy when said storage system receives said swap request from said host

computer. The storage system issues a device busy request to said host computer when

said storage system receives an access request to said first logical volume or said

second logical volume from said host computer upon processing said swap request for

said first logical volume and said second logical volume.

Support for the amendments to the claims is made with reference to Figures

13-16. For example, Fig. 15 shows in a flowchart a flow of processing on the side of

host 101 in the data recovery and disk subsystem 1509 receives a swap request or a

read/write request (step 2001) and disk subsystem 1509 reports "device busy" to host

101 and terminates processing (step 2010). *See* para. [0149], [0154] and so on of

2005-0251517 A1, for example.

Thus, according to a feature of the present invention, it is determined whether

any subsequent read/write requests are directed to a logical volume number 1800

having a corresponding device busy request which is set to busy. If the value indicates

busy, then the disk subsystem reports to the host computer 101 that the device is busy

and terminates further processing of the read/write request, thereby limiting access by

the host to the requested logical volume. *See* para [0154] of 2005-0251517 A1, for

example.

Milligan is relied upon in the Office Action to teach data recovery in the case of

processing failure. Milligan discloses a host computer and a data storage subsystem

with a plurality of disk drives, where modified data records are stored in a cache and

when it is determined a sufficient number of modified data records have been stored in

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the cache, they are written out as an entire logical track and original data records are

tagged as obsolete. *See* col. 2, lines 1-16. Additionally, Milligan is relied upon in the

Office Action to disclose wherein the host instructs the controller to relate the second

logical volume in the second physical storage area to the first logical volume in the first

physical storage area according to a swap request by exchanging positional information

of the first logical volume with that of the second logical volume, so that the controller

accesses the second physical storage area when the controller receives an access request

to the first logical volume from the host computer. However, as recognized in the

Office Action, Milligan fails to disclose where the data of the first logical volume is

interchanged with the data in the second logical volume, as claimed by Applicants.

In addition, Milligan fails to disclose a failure of host computer. Milligan only

discloses physical failure (e.g. a failure of drives or read error) in a storage system. On

the other hand, the present invention has a feature in that a failure in a host computer is

detected. The storage system may not detect a failure of a host computer. Because in a

failure of a host computer, the storage system detects a normal access request without

failure. And then, if the host computer does not issue a swap request to the storage

system, the storage system may not respond to the failure of the host computer.

Furthermore, Milligan fails to disclose where the storage system sets a value of

a device busy request of the positional information on each of the first and second

logical volumes to indicate busy when the storage system receives a swap request from

the host computer, as claimed by Applicants. The meaning of busy as used in the

present invention is different from the meaning of busy as used by Milligan. The

present invention has a technical effect that data consistency in a volume may be kept

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during the swapping process. However, Bachmat fails to disclose that data consistency in a volume may be kept during the swapping process. Bachmat merely discloses that "busy logical volume" indicates a criteria of selecting a volume for a swap request.

Milligan discloses updating a virtual track instance into a logical unit and placing the new location of the virtual track in the logical map so that it may be available to the host processors. Milligan further discloses that the control unit then marks the virtual track instance that is stored in the redundant group as obsolete (710) to prevent the logical location at which the virtual track instance is stored from being accessed during a read or write request by another host. *See* Fig. 7 and col.18, lines 6-24. Accordingly, Milligan fails to disclose the claimed combination as set forth in claims 11, 16, 21, 24, and 27.

Bachmat is further relied upon in the Office Action to supplement Milligan by disclosing a swap/switch process wherein the swapping/switching of data to a spare/unused logical volume occurs in order to backup data in case of a processing failure by the host. Bachmat is directed to a load balancing method, which is controlled by a system manager console, on storage disks to manage the device load associated with physical volumes by monitoring read/write operations on the physical volumes corresponding logical volume. *See* Abstract and col. 8, lines 32-43. The load balancing, as disclosed in Bachmat, occurs with respect to a plurality of physical storage disks which are divided into a plurality of logical volumes for storing data where disk access statistics are recorded for the logical volumes in order to determine the first and second logical volumes to be exchanged. In particular, the exchange occurs by transferring the data on the first and second logical volumes which are located at first and second

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physical volumes through first and second buffers. *See* col. 3, lines 29-45. As disclosed

in Bachmat, the exchange has the purpose of reducing the load on a physical disk by

swapping a high activity logical volume stored on a first physical volume with a low

activity logical volume stored on a second physical volume. *See* col. 8, lines 32-43.

Bachmat discloses that the operating system in host is notified to redirect all the I/O

requests for the logical volume to the BCV volume. *See* col. 9, lines 35-37.

On the other hand, as claimed by Applicants, the host computer issues a swap

request to said storage system, the swap request exchanging positional information of

the first logical volume with that of the second logical volume, so that data of said first

logical volume is interchanged with data of said second logical volume and said

controller accesses said second physical storage area when said controller receives an

access request to said first logical volume from said host computer. Further, storage

system issues a device busy request to said host computer when said storage system

receives an access request to said first logical volume or said second logical volume

from said host computer upon processing said swap request for said first logical volume

and said second logical volume.

As a result, the present invention has a technical effect that the host computer

does not need any particular software (e.g. volume management software) and the host

computer does not need to be changed, making it possible for the user to use the current

host computer. Further, the recovery process may be executed quickly so that the

computer issues a swap request to the storage system directly. Further, the computer

does not need to use resource for the swapping process so that the storage system

execute the swapping process, instead of the computer.

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Additionally, the storage system sets the value of a device busy request of the positional information of each of the first logical volume and the second logical volume to indicate busy when the storage system receives the request from the host, as claimed by Applicants. Accordingly, Bachmat fails to overcome the abovementioned deficiencies noted in Milligan that are recognized in the Office Action.
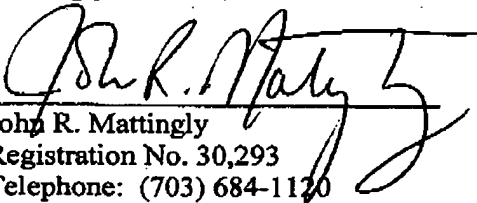
In view of the foregoing remarks and amendments, Applicants submit that the combination of Milligan in view of Bachmat fails to render unpatentable claims 11, 12, 14-17, 19-22, 24-30.

Conclusion

In view of the foregoing, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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Date: May 11, 2009

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